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(71) Applicant(s)
Unilever Plc
(Incorporated in the United Kingdom)
Unilever House, Blackfriars, LONDON, EC4P 4BQ,
United Kingdom

(72) Inventor(s)
Shovan Ganguli
Anitha Rao
Navin Kumar Sharma

(74) Agent and/or Address for Service
David John Butler
Patent Division, Unilever PLC, Colworth House,
Sharnbrook, BEDFORD, MK44 1LQ, United Kingdom

(54) Abstract Title
Manufacture of black tea involving amino and phenolic acids

(57) A method of manufacturing black tea comprises the step of treating the green leaf tea with a combination of phenolic acids and amino acids prior to the fermentation step. The amino and phenolic acids are preferably used in amounts that provide a synergistic increase in the content of benzaldehyde or phenylacetaldehyde. The ratio of amino acid to phenolic acid may be between 1:0.1 to 1:5 and the green leaf tea is preferably treated with the acids for 10 minutes to 2 hours at 10 to 45°C. The amino acid is preferably phenylalanine, threonine, alanine, leucine or isoleucine and the phenolic acid is preferably cinnamic acid, ferulic acid or chlorogenic acid. The green leaf tea may be treated with the amino and phenolic acids in the ratio 1:0.01 to 1:10 singly or in split doses. The method improves the aroma of the tea.

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A METHOD FOR MANUFACTURING BLACK TEA

The invention relates to a method for obtaining improved aroma composition of final tea. The invention particularly relates to a process of treating tea leaves post plucking with a combination aroma enhancing compounds to improve the aroma of tea.

Background and prior art

Leaf tea may be prepared as green leaf tea or black leaf tea. The method of preparing such teas is well-known to those skilled in the art. Generally, to prepare black leaf tea, fresh green leaves of the plant *Camellia sinensis* are withered (subjected to mild drying), comminuted, fermented (in which process enzymes in the tea leaf use atmospheric oxygen to oxidise various substrates to produce brown-coloured products) and then fired (to dry the tea leaves). Green leaf tea is not exposed to the fermentation process. Partial fermentation may be used to produce intermediate-type teas known as "Oolong" tea.

It is known to treat green tea with various amino acids during black tea processing to enhance flavour. For example Japanese patent specification JP 72049719 discloses treating tea prior to heating with an amino acid selected from glutamic acid, threonine, methionine, leucine, isoleucine, alanine, glycine, tryptophane, sodium aspartate, valine, phenylalanine, arginine hydrochloride, lysine hydrochloride, histidine and 1,3-dihydroxy-2-propane in order to improve the flavour and taste of teas.

The present have inventors have surprisingly found that one can significantly enhance the aroma of black tea by treating the green

tea with a synergistic combination of amino acids and phenolic acids.

Statement of the invention

The present invention in broad terms relates to a method for manufacturing black tea comprising the steps of withering, macerating, and fermenting green leaf tea the method being characterised in that the green leaf tea is treated with a combination of phenolic acids and amino acids prior to the fermentation step.

"Tea" for the purposes of the present invention means leaf material from *Camellia sinensis var. sinensis* or *Camellia sinensis var. assamica*. It also includes rooibos tea obtained from *Aspalathus linearis* however that is a poor source of endogenous fermenting enzymes. "Tea" is also intended to include the product of blending two or more of any of these teas.

"Leaf tea" for the purposes of this invention means a tea product that contains one or more tea origins in an uninfused form.

For the avoidance of doubt the word "comprising" is intended to mean including but not necessarily "consisting of" or "composed of". In other words the listed steps or options need not be exhaustive.

Except in the operating and comparative examples, or where otherwise explicitly indicated, all numbers in this description indicating amounts or concentrations of material ought to be understood as modified by the word "about".

Detailed description of the invention

Tea manufacture, especially black tea manufacture, traditionally comprises four basic steps: withering, rolling, fermenting and firing.

Withering is a process whereby the plucked tea leaves are stored for periods of time (perhaps up to 24 hours), during which they undergo various biochemical and physical changes which often includes a loss of moisture.

Maceration follows the withering step, and traditionally the withered leaves are optionally rolled to bruise and crush the leaves i.e. break down the plant tissue structure. This will have the effect of liberating fermentable substrates and fermenting enzymes from within the plant cells and tissue. Modern tea manufacture usually includes this step however the plant cells and tissue is broken down by passing tea, which has usually been withered, through a cutting machine.

The next step is commonly called fermentation but that is a misnomer. "Fermentation" is commonly used in the context of brewing alcohol to describe the action of exogenous enzymes. However in the tea world it is used to refer to the oxidative process that tea undergoes when certain endogenous enzymes and substrates are brought together by mechanical disruption of the cells by tearing or cutting the leaves. During this process colourless catechins in the leaves are converted to a complex mixture of yellow and orange to dark-brown substances and producing a large number of aromatic volatile compounds.

The colourful oxidation products include theaflavins and thearubigens. Theaflavins comprise several well-defined catechin condensation products that are characterised by their benzotropolone ring. Thearubigens are a group of undefined

molecules with a large variance in molecular weight. They have a large variety of colours ranging from yellow to dark red and brown.

Phenylacetaldehyde and benzaldehyde are the major aroma components and are formed during the fermentation stage. During the process of fermentation, the quinones formed from catechins by the action of enzyme polyphenol oxidases/peroxidases convert phenyl alanine into phenyl acetaldehydes. Phenyl acetaldehydes impart floral aroma whereas benzaldehyde has a sweet almond like aroma.

The fermented product is fired and dried to give a black leaf tea. The firing involves heating and drying the tea to destroy the fermenting enzymes and thereby arrest fermentation. It results in a reduction of moisture content to below 5%, and also leads to further chemical oxidation and changes in tea aroma. This generally involves exposing the tea to a blast of hot, dry air in a dryer.

The present invention concerns an improved method of black tea manufacture that involves treating plucked tea leaves with one or more amino and phenolic acids prior to the step of fermentation.

Preferred amino acids include phenylalanine, threonine, alanine, leucine and isoleucine. Phenylalanine and threonine are especially preferred.

Preferred phenolic acids include cinnamic acid, ferulic acid, and chlorogenic acid. Cinnamic acid is especially preferred.

The application of the aroma enhancing compounds is post plucking and prior to fermentation and preferably the compounds are in the form of a solution. The application of the aroma inducing compounds is either singly or in split doses.

The treatment is given in the form of a spray or dip.

The ratio of amino acid to phenolic acid is preferably in a ratio of 1:0.1 to 1:5.

The duration of the treatment is for 10 minutes to 2 hours.

The temperature during the treatment is maintained at 10 to 45 °C and preferably at 15 to 30 °C.

After treatment with the aroma enhancing agent, the shoots are withered and fermented following the normal procedure.

The invention now will be illustrated with reference to the following example.

EXAMPLE

Freshly harvested green leaves or the withered leaves (3 kg) were sprayed with 100 ml aqueous solution of amino acid (phenylalanine) and phenolic acid (cinnamic acid) after the maceration stage in a ratio at a final concentration of the active ingredient as indicated in Table 1, at a temperature of about 25 °C for 1 hour. Leaves without the phenylalanine and cinnamic acid treatment were used as control. Leaves were also fermented using phenylalanine or cinnamic acid alone for comparison. The samples were analysed for the aroma component by gas chromatography (GC) and the results are presented in Table 1 below.

TABLE 1 : Effect of combination of amino acid and phenolic acid

Treatment	GC Peak area Benzaldehyde	GC Peak area Phenylacetaldehyde
Control	19734	40696
Cinnamic acid, 0.2%	30585	29423
Cinnamic acid, 0.4%	97399	46006
Phenylalanine, 0.2%	112730	415195
Phenylalanine, 0.4%	262819	864379
Phenylalanine, 0.2% + Cinnamic acid, 0.2%	177855	534765
Phenylalanine, 0.4% + Cinnamic acid, 0.4%	181833	929691

The results clearly show that when tea leaves are treated with a combination of an amino acid and a phenolic acid during the tea processing, the level of phenylacetaldehyde which imparts a floral aroma and benzaldehyde that imparts a sweet almond like aroma, to teas was increased synergistically as compared to a treatment with either the amino acid or the phenolic acid alone. The cinnamic acid treated teas, in addition to imparting a floral note also add to the astringency.

CLAIMS

1. A method for manufacturing black tea comprising the steps of withering, macerating, and fermenting green leaf tea and firing the fermented tea to give black tea, the method being characterised in that the green leaf tea is treated with a combination of phenolic acids and amino acids prior to the fermentation step.

2. A method according to claim 1 wherein the green leaf tea is treated with the amino and phenolic acids in amounts that provide a synergistic increase in the content of benzaldehyde or phenylacetaldehyde.

3. A method according to claim 1 wherein the ratio of amino acid to phenolic acid is between 1:0.1 and 1:5.

4. A method according to any one of claims 1 to 3 wherein the amino acid is selected from the group consisting of phenylalanine, threonine, alanine, leucine and isoleucine.

5. A method according to claim 4 wherein the amino acid is phenylalanine or threonine.

6. A method according to any one of claims 1 to 3 wherein the phenolic acid is selected from the group consisting of cinnamic acid, ferulic acid, chlorogenic acid and cinnamic acid.

7. A method according to claim 6 wherein the phenolic acid is cinnamic acid.

8. A method according to claim 1 wherein the green leaf tea is treated with the acids for 10 minutes to 2 hours.

9. A method according to claim 1 wherein the temperature during the acid treatment is maintained at 10 to 45 °C.

10. A method according to claim 1 wherein the green leaf tea is treated with the amino acid and phenolic acids in a ratio of 1:0.01 to 1:10 singly or in split doses, for 10 minutes to 2 hours at a temperature of 10 minutes to 2 hours at a temperature of 10 to 45 °C.

11. A method for making black tea with enhanced aroma substantially as herein described with reference to the example.

The Patent Office

INVESTOR IN PEOPLE

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Other: Online: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	GB 2074004 A (TEA RESEARCH) see especially page 1, lines 58-59 and example 1	1,4,8,9
Y	WPI Abstract AN 90-252169 [33] & SU 1517903 (TSOTSIASHVVILI) see abstract	1,4,8,9
Y	WPI Abstract AN 89-261697 [36] & SU 1442167 (GEOR. SUBTROPIC INST) see abstract	1,4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.